Foundations of Statistical Inference II
Rice STAT 533 / GSBS01 1283
Spring 2020

Instructor: James Long

Lectures: T/Th 1:00PM - 2:15PM, Rice KCK 107

Course Description: Theoretical foundations for hypothesis testing and confidence set construction with an emphasis on recent developments (last 20 years) in multiple testing.

Learning Outcomes: At the end of this course students will be able to:

1. Construct and derive theoretical properties of statistical hypothesis tests such as Uniformly Most Powerful tests, asymptotic tests (likelihood ratio, Wald, chi-square), Bayes Factors, and p–values.
2. Construct and derive theoretical properties of confidence sets using pivotal quantities, asymptotic approximations, and the bootstrap.
3. Derive theoretical properties of multiple testing procedures such as the false discovery rate and local false discovery rate as well as empirical Bayes approaches to testing.

Prerequisites: Rice STAT 532 covering selections of Chapters 1–5 of Shao. It is not strictly necessary to have taken 532, but 533 will build on many of the 532 concepts (such as maximum likelihood estimators).

Textbooks:

- Shao. Mathematical Statistics (second edition). Required. We will cover most of Chapters 6 and 7.
- Efron. Large-Scale Inference: Empirical Bayes Methods for Estimation, Testing, and Prediction. Available free online. We will cover selections from chapters 1-5, focusing on the theoretical aspects of False Discovery Rate (FDR) and local FDR.

Instructor Office Hours: By appointment in FCT 4.6082. I will also be available after class to discuss issues. I prefer to discuss questions about course material in person. Administrative issues can be handled by email.

Instructor email: jp followed by my last name @mdanderson.org

Tentative Course Schedule: The following is a tentative course schedule. A more detailed schedule will be posted on the course website as the course progresses.

- Weeks 1–5: Shao Chapter 6
- Weeks 6–10: Shao Chapter 7
- Weeks 11–14: Efron Selections from Chapters 1–5

Grading Policy: You will receive a percent correct (0-100) on the homeworks and exams. These percentages are weighted:

$$25\% \text{ homework} + 25\% \text{ exam 1} + 25\% \text{ exam 2} + 25\% \text{ exam 3}$$

Homework: Questions mostly from textbook. Solutions turned in at the beginning of class. About one problem set per week. Students are encouraged to work together, but the answers must be your own. No late homework accepted.

Website: Homework assignments and important course information will be posted on the course website `https://longjp.github.io/533`.

Important Dates (Tentative):

- Exam 1: Tuesday, February 11 (during class time)
- Exam 2: Tuesday, March 24 (during class time)
- Exam 3: Thursday, April 23 (during class time)

Absence: Class attendance is required but not explicitly graded. Only university excused absences will be accepted for missing homework or exams. Documentation will be required. If you know you will miss an exam for a valid reason, please see or email me as soon as possible.

Unexcused Absence Policy: Unexcused absences will be considered on a case–by-case basis.

Disabilities: If you have a documented disability that will impact your work in class, contact the instructor. In addition, you need to be registered with Disability Support Services Office in the Rice University Allen Center or the equivalent at your respective academic institution. The policies of Rice University regarding disabilities are observed: see http://ga.rice.edu/.

Copyright Notice: The handouts used in this course are copyrighted. By "handouts" I mean all materials generated for this class, which include but are not limited to syllabi, quizzes, exams, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts, unless I expressly grant permission.

Honor Code: The course is governed by the Honor Code of Rice University.

Other policies: All other policies of Rice University are observed: see `http://ga.rice.edu/`